# $CO_2$ Capture from Flue Gas By Phase Transitional Absorption

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## SUMMARY

At current point, the cost to capture carbon dioxide from flue gas is very high. As reported [Herzog, H. Editor, The Capture, Utilization and Disposal of Carbon Dioxide from Fossil Fuel-fired Power Plants. DOE/ER-30194, 1993; Vol.1], the energy penalty for monoethnolamine process for $CO_2$ capture from coal fired power plant is about 35 %, still about 15 % for best case [Herzog, H., E. Drake, and E. Adams, ed. $CO_2$ Capture, Reuse, and Storage Technologies for Mitigating Global Climate Change, A White Paper Final Report. January, 1997. DOE Order No. DE-AF22-96PC01257]. Reported recently developed the processes such as sterically hindered amines or formulated amines could save regeneration cost by up to 40 %, the separation cost per ton of $CO_2$ ranges from 40 to 70 US dollars[Chakma, A. and P. Tontiwachwuthikul. Designer Solvents for Energy Efficient $CO_2$ Separation. Greenhouse gas Control Technologies, Riemer, P., B. Eliasson and A. Wokaun, editors, 1999 Elsevier Science Ltd.]. An economic tradeoff in capital investment would likely occur since the slower reacting amines will require a larger absorber (longer gas-liquid contact time) to achieve the same $CO_2$ capture as compared to MEA process [International Journal of Environmental Technology and Management, Vol. 4, Nos. ½, 2004].

This research is to use Phase Transitional Absorption to improve the cost of $CO_2$ capture. Based on our initial study, the Phase Transitional Absorption can reduce the operation cost by 80 %, and also significantly cut the capital investment
Our initial study indicated that the absorption rate by using the technology of phase transitional absorption had amazing results. The absorption rate by phase transitional

absorption (80 % solvent B and 20 % activated agent A) was faster than MEA (20% by volume) aqueous solution, 3 times faster than DEA (20 % by volume) aqueous solution, 3 times faster than ammonium carbonate solution (150 g/L), 7 times faster than $K_2CO_3$ (150 g/l), 6 times faster than DEA (2% by volume) activated $K_2CO_3$ (150 g/l).

The $CO_2$ loading capacity by phase transitional absorption is 4 - 6 times higher than that by standard 20 % MEA solution.

Our study showed that regeneration started at about 80 $^oC$. However, the decomposition amount of $A{\cdot}CO_2$ is the function of temperature. The total percentage of the carbon dioxide in solution was evolved up to the temperature.